

**RETURN AIR APPARATUS WITH DOWN DRAFT DIVERTER**

**RELATED APPLICATION**

**[0001]** This application claims the benefit of U.S. Provisional Application No. 60/430,201, filed December 2, 2002.

## FIELD OF THE INVENTION

**[0002]** The present invention relates to a recreational vehicle with an air conditioning or heating system and, more particularly, to an air conditioning or heating system having a ceiling grille.

## **BACKGROUND OF THE INVENTION**

**[0003]** Recreational vehicles, such as mobile homes, motor homes, campers, travel trailers, fifth wheelers, recreational vans, and other vehicles with an interior primary living space or area, commonly have air conditioning systems to provide cool dehumidified air to an interior of the recreational vehicle. The air conditioning system typically has a rooftop mounted air conditioning unit or heat pump unit and ducts for distributing the conditioned air. The conditioned air is discharged from the ducts into various area and/or rooms through registers.

**[0004]** U.S. Patent 5,531,641, discloses a recreational vehicle with an air conditioner ceiling grille that includes a return air grille and a closable register. The register may be manually opened or closed by an operator to discharge air to the local area below the register.

## SUMMARY OF THE INVENTION

**[0005]** The present invention provides a return air apparatus with a down draft diverter. The invention includes a direct discharge option, an improved air filtration system, and an improved installation with reduced steps. The invention is used with an air comfort control device or appliance unit that cools or refrigerates and/or heats air, such as an air conditioning unit or heat pump unit.

**[0006]** The invention allows for direct discharge of air from an appliance unit by opening and closing a ceiling template opening, rather than a grill louver. This yields reduced air outlet resistance and 100% air through the direct discharge option on the apparatus. The direct discharge option is opened and closed with a single action by a down draft diverter. The direct discharge option may also have a discharge opening with preset-opening percent detents allowing for partial air supply.

**[0007]** The improved air filtration system has two layers of electrostatic media. The filter is positioned to be remote from the grillwork to maximize the filter area and minimize air flow resistance. The filter position also allows the inlets to be separated throughout the return air cover without requiring filters on each opening in the cover. The improved installation has a tear-off air barrier, that is self-adhesive, self-sealing, and pre-cut forming. Hidden fasteners and the grillwork improve the visual appearance of apparatus. The invention may also include a dirty filter indicator that is resettable and a solar panel battery charging indicator option.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]** Further features and details of the present invention will be apparent with reference to the following description and drawings.

**[0009]** FIG. 1 is an exploded perspective view of a return air cover with return air grille and slide, ceiling template, air barrier, and filter; and

**[0010]** FIG. 2 is a perspective view with designating air flow paths for the return air cover with return air grille and down draft diverter according to FIG 1.

## DETAILED DESCRIPTION OF THE INVENTION

**[0011]** FIGS. 1 and 2 shows an embodiment of the invention for use in a recreational vehicle having an air comfort control device or appliance unit that cools or refrigerates and/or heats air, such as an air conditioning unit or heat pump unit. The air comfort appliance unit is generally located over an opening in the recreational vehicle roof. There is also an opening in the ceiling of the recreational vehicle below the roof opening generally having the same dimensions as the roof opening. The openings are framed to form a plenum area below the air comfort appliance unit. The return air apparatus is located in the plenum area and over the opening in the ceiling.

**[0012]** As seen in FIG. 1, the return air apparatus 10 comprising an air barrier 11, a ceiling template 12, a down draft diverter 13, a return air cover 14, circuit boards 15, a return air grille 17, a decorative cover 18, a slide handle 19, a filter 20, and miscellaneous fasteners, insulation, and plastic parts. The ceiling template 12 is located at the ceiling of the recreational vehicle below the ceiling opening. The ceiling template 12 includes a discharge opening 22 and a return opening 24. A first flange 26 extends upwardly from the top surface of the ceiling template forming an upwardly extending wall around the perimeter of the discharge opening 22. A second flange 28 extends upwardly from the top surface of the ceiling template from an upwardly extending wall around the perimeter of the return opening 24. The ceiling template 12 includes bolt openings so that bolts can attach the ceiling template to the air comfort appliance unit. The ceiling template 12 may also have insulation where needed to properly fit or seal the ceiling template within the ceiling opening. The ceiling template 12 should be made of a material having adequate strength to support the loads required to mount the appliance unit, such as, for example, steel sheet.

**[0013]** The air barrier 11 is formed to conform with a side of the second flange 28 of the return opening 24 that is adjacent to the discharge opening 22. The air barrier 11 extends from the ceiling template 12 to the air comfort appliance unit to divide and seal the plenum area between the ceiling template and air comfort appliance unit into a discharge section and a return section. The discharge section is in communication with an outlet of the air comfort appliance unit, and the return section is in communication with an inlet of the air comfort appliance unit

**[0014]** The air barrier 11 has perforated sections 30, which provide tear-off strips to allow sizing for various depth ceilings, and is self-sealing to the air comfort appliance unit. Tape may be required to seal the ends of the air barrier 11 to the ceiling opening, however, the seal between the air barrier 11 and the air comfort appliance unit is by compression of the barrier material. The air barrier 11 is preferably made of a stiff, compressible insulating material.

**[0015]** The return air cover 14 is the aesthetically main viewed component of the apparatus. The return air cover 14 is located at the ceiling below the ceiling template 11 and conceals the ceiling template 11 when installed. The return air cover 14 has a generally rectangularly-shaped panel with a cavity housing other plastic and circuit board components. The return air cover 14 also includes a direct discharge opening 40 and a return opening 42, which are located below the discharge opening 22 and return opening 24 of the ceiling template 12, respectively, when the return air cover 14 is mounted to the ceiling template 12. The return air cover 14 is attached to the ceiling template 12 with standard fasteners or, alternately, snap locks. The return air cover 14 may also be attached by other known fastening means. The return air cover 14 is preferably molded of a plastic material.

**[0016]** A down draft diverter or slide 13 is positioned in the air return cover 14 over the direct discharge opening 40 of the air return cover 14. The slide 13 is positionable to allow adjustment to any degree of openness of the discharge section 40 with a single action or motion. The

slide 13 may have a rib (not shown) on one surface that interacts with mating grooves 50 spaced in the return air cover in intervals to preset or create desirable detent stop positions. The detent stop positions allow an operator to set the discharge section in predetermined degrees of openness, such as, for example, full closed, one-fourth, one-half, and full open. The slide 3 is preferably molded of a plastic material.

**[0017]** The return air grille 17 is attached to the return air cover opening. The return air grille extends across the direct discharge opening 22 and return opening 24 of the return air cover. The return air grille 17 is snapped into place on the return air cover 14 by latches molded into both the return air grille 17 and the return air cover 14. The return air grille 17 may also be attached to the return air cover by other known fastening means. The return air grille 17 is preferably molded of a plastic material.

**[0018]** A divider flange 52 divides the return air grille 17 into first and second sections 54, 56. The first section 54 is located below the discharge opening 22 of the return air cover 14. The first section 54 communicates the discharge portion of the plenum area with the interior of the recreational vehicle so that air can be discharged into the recreational vehicle directly below the air comfort appliance unit. The second section 56 is located below the return opening of the return air cover 14. The second section 56 communicates the return portion of the plenum area with the interior of the recreational vehicle, so that air can be returned to the air comfort appliance unit.

**[0019]** The slide handle 19 is inserted through an opening (not shown) in the return air grille 17 and is snapped into the slide 13. The slide handle 19 provides a grip for the operator to move the slide 13 with a single action or motion. The slide handle 19 is preferably molded of a plastic material.

**[0020]** The filter 20 is located over the return opening 24 in the return air cover 14 to improve air quality to the air comfort appliance unit and prevent dirt accumulation on surfaces of the air comfort appliance unit. The filter 20 has a filter pull tab 60 located at one end to remove and replace the filter without tools. The filter 20 may be installed between guides in the cover and into a receiving channel until a detent tab engages and holds the filter position in the cover. The filter pull tab may also be stopped by protrusions on the cover. The filter 20 is positioned remote from the return air grille 17 to maximize filter area and to minimize air flow resistance. The filter 20 position also allows inlets to be separated throughout the return air cover 14 without requiring filters on each opening in the return air cover. The filter 20 is preferably a combination of two layers of electrostatic media molded into a plastic frame.

**[0021]** The circuit boards 15, 16 are mounted in the return air cover indicating functions for the operator. A decorative cover 8 installed on the cover may also indicate operation of the circuit boards. One circuit board 15 indicates to the operator when it is time to replace the filter. The filter indicator is turned off by pushing on the face of the decal decorative cover in a manner similar to activation of a pressure switch. The indicator is preferably a simple timer that activates a light after a predetermined period of days since the timer was last reset. The second circuit board 16 is an indicator that a solar panel is charging the vehicle battery. It has no operator interface, but indicates with a light when the solar panel, if installed, is charging. The circuit boards can be supplied standard with the apparatus or installed to the return air cover. The circuit boards can also be supplied as aftermarket accessories.

**[0022]** The invention can be installed in a vehicle with a new appliance unit, such as an air conditioner unit or heat pump unit, or to an existing model appliance unit, which was prepared and positioned for installation with standard procedures. The air barrier 11 is torn to size along the appropriate perforated sections 30, the tape liner is then removed, and the barrier is folded and

adhered to the ceiling template 12. Electric controls can be installed to the ceiling template 12 or, alternately, are mounted elsewhere. The ceiling template 12 is inserted into the ceiling opening of the vehicle into an installation position and then attached to the appliance unit with bolts through existing holes in the ceiling template and into the appliance unit. Tape may be required to seal the ends of the air barrier to the vehicle cavity. The seal to the appliance unit is by compression of the barrier material.

**[0023]** The slide 13 is positioned in the return air cover 14, and both the slide and cover are placed in position over the ceiling template 12. The return air cover 14 is then attached to the ceiling template 12. The wiring may then be connected attaching the circuit boards to the vehicle power sources. The return grille 17 is snapped into place on the return air cover 14, and the slide handle 19 is inserted through appropriate opening in the grille and snapped into the slide. Finally, the filter 20 is installed between the return air cover 14 and ceiling template 12.

**[0024]** The apparatus may be operated with existing thermostats calling for air circulation, with or without cooling or heating, and in conjunction with an existing model air conditioner unit or heat pump unit. FIG. 2 shows the air flow paths for the return air cover with return air grille and slide. Return air enters the apparatus through openings in the return air grille 17, through openings in the return air cover 14, and through openings between return air cover 14 and the interior vehicle surface (not shown). During operation, air is normally discharged by the air comfort appliance unit into the roof or wall cavity and into duct work in the vehicle, or directly into duct work. Air can also be diverted down and discharged directly through the discharge opening of the return air grille 17, by moving the slide 13 in the return air cover 14. This creates an opening between the slide 13 and the ceiling template 12 from which the air can escape through. The direct discharge option of opening and closing a ceiling template opening, rather than a grill louver, yields reduced air outlet resistance

and 100% air through the discharge opening on the apparatus. The direct discharge option may also use a discharge opening with preset-opening percent detents allowing for partial air supply.

[0025] While the invention has been described with reference to a specific embodiment, various changes may be made and equivalents may be substituted for elements thereof by those skilled in the art without departing from the scope of the invention. In addition, other modifications may be made to adapt a particular situation or method to the teachings of the invention without departing from the essential scope thereof.